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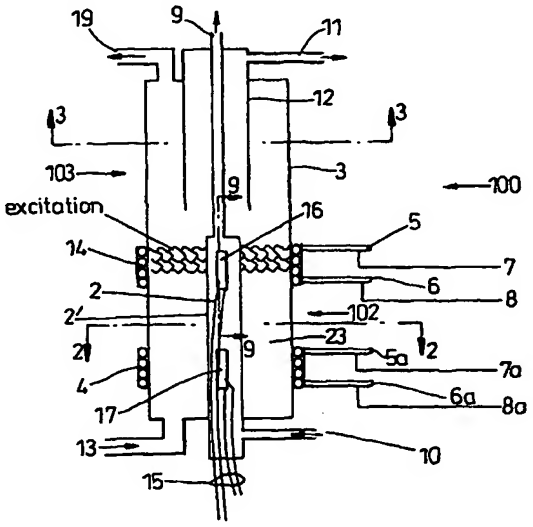
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PARTICLE SEPARATION



(57) Abstract: A laminar or cyclonic particle separator for gas, liquid-liquid and fluidizable solids separation comprised of a section with a non-metallic housing having an annulus and a chamber, an optional anode cooled with a first coolant in and a first coolant out disposed in the chamber, a DC or pulsating DC power source connected to the anode, at least one magnetic coil disposed adjacent the chamber and cooled with a second coolant, a high voltage pulsating DC power source connected to the magnetic coil, and a fluid (gas, liquid or fluidizable solids) inlet port connected to the housing, and also a section with a non-metallic separator tube connected to the housing and disposed within the housing, a first fluid outlet connected to the annulus through the housing. This device can then separate a stream rich in a targeted element (first fluid) and a stream lean in a targeted element (second fluid) from the device and thus discharge a stream almost free of the targeted element or almost 100 % the targeted element.

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AMENDED CLAIMS

[(received by the International Bureau on 07 November 2003 (07.11.03); original claims 1-41 replaced by new claims 1-42 (7 pages)]

+ STATEMENT

1. A particle separator for separation of first and second mixed fluids, as hereinbefore defined, comprising a non-metallic housing containing an annular through-flow chamber, an inlet to the housing for introduction of a mixture of the first and second fluids into said through-flow chamber, a portion of said through-flow chamber being encircled by a magnetic coil, an anode encircled by said chamber portion, coil cooling means for cooling the magnetic coil by means of a first coolant, a cooling conduit extending through said chamber portion and adapted to cool said anode by means of a second coolant, a high voltage pulsating DC power source connected to said magnetic coil, a further DC power source connected to said anode, fluid separation means positioned downstream of said through-flow chamber portion to receive energised fluid mixture that has been subjected to the magnetic field created by pulsing of the magnetic coil, the fluid separation means being so arranged as to separate the first and second fluids from the energised mixture.

2. The separator of claim 1, in which a pulsating DC power source is connected to said anode;

3. The separator of claim 1 or claim 2, wherein said anode is tubular.

4. The separator of any of the preceding claims, wherein the non-metallic housing comprises one of glass, polyethylene, polypropylene, polybutylene, polyketone, polycarbonate, polyvinyl chloride, polyvinyl acetate, ceramic, wood, fibreglass, cross linked polymers, non-cross linked polymers, other non-magnetic materials, or mixtures thereof.

5. The separator of any of the preceding claims, wherein the non-metallic housing has a coated interior.

6. The separator of claim 5, wherein the coated interior is coated with a corrosion resistant material.

7. The separator of claim 6, wherein the coated interior is a friction reducing coating.

8. The separator of any one of the preceding claims, wherein the anode is disposed within and near the axis of the cooling conduit.

9. The separator of any one of the preceding claims, wherein two anodes are disposed in the chamber.

10. The separator of claim 2, or any one of claims 3 to 9 each as appended to claim 2, wherein the pulsating DC power source to said anode is arranged to be synchronized with the pulsating DC power supply to said magnetic coil.

11. The separator of any one of the preceding claims, wherein the pulsating DC power source to said magnetic coil pulses at an atomic resonance frequency so chosen as to match the frequency of discrete ions or elements of said first or second fluid.

12. The separator of any of the preceding claims, wherein the first and second coolants are selected from the group: distilled water, glycerine, a dielectric transformer coolant, and mixtures thereof.

13. The separator of any one of the preceding claims, wherein the magnetic coil is wrapped around the housing.

14. The separator of claim 13, wherein the magnetic coil is torridly wrapped around the housing.

15. The separator of claim 14, wherein the magnetic coil is wrapped around the housing in a plurality of individual torridly compressed loops.

16. The separator of claim 15 in which said loops each comprise arcuate sections each of tuned length.

17. The separator of any one of the preceding claims, wherein a magnetic coil is disposed in the cooling conduit spaced apart from said anode.

18. The separator of any one of claims 1 to 12, wherein two magnetic coils are wrapped around the housing.

19. The separator of any one of claims 1 to 12, wherein the magnetic coil is disposed in the housing.

20. The separator of any one of the preceding claims wherein the anode is a member of the group: solid metal wire and a suitable core.

21. The separator of claim 20, wherein the metal is electrically conductive.

22. The separator of any one of the preceding claims, further comprising an electro-magnetic shielding system disposed around the separator.

23. The separator of any preceding claim in which the portion of the chamber encircled by the magnetic coil is choked so as to diminish the diameter of the annular through-flow chamber.

24. A separator as claimed in any one of the preceding claims in which said fluid separation means is a laminar fluid separation means.

25. A separator as claimed in claim 24 in which the laminar fluid separation means comprises a funnel defining a first outlet within the funnel and a second annular outlet external to the funnel, the relative cross-sectional areas of the entrance to the funnel, and the annular space around the funnel entrance being so chosen according to the amount of the targeted element in the mixture to be subjected to separation.

26. A separator as claimed in any one of claims 1 to 23 in which the fluid separation means is a cyclonic separator.

27. A separator as claimed in claim 26 in which the fluid separation means comprises two cyclonic separators.

28. A laminar particle separator for liquid-liquid separation comprising a lower section comprising a non-metallic housing having an annulus and a chamber, at least one magnetic coil disposed adjacent the chamber and cooled with a first coolant, a high voltage pulsating DC power source connected to said magnetic coil; and a fluid inlet port connected to the housing, an upper section comprising a non-metallic separator tube connected to the housing and disposed within the housing, a first fluid outlet connected to the non-metallic separator tube, and a second fluid outlet connected to the annulus through the housing.

29. A cyclonic particle separator for liquid-liquid separation comprising a non-metallic housing with a chamber, at least one magnetic coil disposed adjacent the chamber and cooled with a first coolant, a high voltage pulsating DC power source connected to said magnetic coil, at least one cyclonic separator disposed in the chamber and wherein said cyclonic separator has a fluid inlet, and brine outlet, and a cyclonic separator freshwater outlet; and a freshwater outlet fluidly connected with the cyclonic separator freshwater outlet.

30. A laminar method for particle desalination comprising using a tube and a magnetic coil disposed in a chamber, flowing seawater into the chamber and out of a brine outlet and a freshwater outlet and simultaneously energising the magnetic coil, creating freshwater in the chamber, flowing the freshwater near the tube and attracting the freshwater into a separator tube; and flowing the freshwater from the separator tube into the freshwater outlet.

31. A method of separating a selected component from a mixture of fluids, as hereinbefore defined, comprising introducing the mixture to a chamber and subjecting the mixture in a portion of the chamber to a magnetic field created by subjecting a liquid-cooled coil encircling said chamber portion to DC voltage pulses of characteristics chosen to energise the selected component of the mixture, and whist the selected component remains at least partially energised, using a separation means which is adapted to divert the energised components to a different outlet from that to which relatively unenergised components of the mixture pass.

32. The method of claim31, wherein said energising comprises using at least one pulsating frequency which matches the atomic frequency of at least one component being separated.

33. The method of claim 32 , where a plurality of atomic frequencies of materials are matched through a digital indexing through specific frequencies using a magnetic field.

34. The method of claim 33, wherein the matching step is performed using a magnetic field using discrete atomic (NMR) frequencies.

35. A method as claimed in any one of claims 31 to 34 in which said separation means employs a laminar method for separating two flows of materials, a separator tube being arranged to separate the two laminar flows to direct said flows to different outlets.

36. The method of claim 35, wherein separated material flows through the separator tube using the Coanda effect.

37. A method as claimed in any one of claims 31 to 34 in which said separation means employs a cyclonic method for creating two separate flows of materials.

38. The method of any one of claims 31 to 37, wherein an anode is located in said portion of the chamber and said anode is simultaneously energised with said magnetic coil.

39. A cyclonic method for particle desalination comprising using a tube and a magnetic coil disposed in a chamber, flowing seawater into the chamber and out of a brine outlet and a freshwater outlet and simultaneously energising the magnetic coil, creating freshwater in the chamber, using cyclonic forces to maintain a separation between the freshwater in the chamber and the seawater flowing into the chamber; and flowing the freshwater near the tube and attracting freshwater from the cyclonic separator outlet into the freshwater outlet.

40. The method of any one of claims 31 to 38 in which the mixture is in the form of fluidised finely ground dry materials.

41. The method of any one of claims 31 to 39 in which the mixture is a mixture of liquids.

42. The method of claim 40 in which the mixture is salt water.

Statement Under Article 19 (1)

International PCT Patent Application No PCT/GB2003/002124
Claiming Priority from US Provisional Patent Application No 60/381023 for
Atomic Particle Separation

New claim 23 specifies a separator in which the portion of the chamber encircled by the magnetic coil is choked so as to diminish the diameter of the through-flow chamber. The basis of this claim is set out on page 32 of the description lines 5 and 8 and is illustrated in figure 9. It is also referred to on page 3 of the description line 18 . This is distinct from the arrangements shown in the documents cited in the International Search Report, none of which discloses or suggests a choked portion of the chamber which is encircled by the magnetic coil.

In the interest of clarity the words 'located in' in line 7 of claim 1 have been replaced by the words 'encircled by' and the word 'the' in claim 17 line 5 had been corrected to 'a'.

INTERNATIONAL SEARCH REPORT

Internatic ation No
PCT/GB 03/02124

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B03C1/023 B03C1/035 C02F1/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B03C C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 35 21 109 A (INTERATOM) 18 December 1986 (1986-12-18) abstract; figure 1	29 30,34,37
Y	US 4 458 153 A (WESLEY RICHARD H) 3 July 1984 (1984-07-03) column 3, line 48 -column 4, line 43; figure 1	1-4,8,9, 13-15, 23,27, 30,34,37
Y	US 5 224 604 A (SCHNEIDER JAKOB H ET AL) 6 July 1993 (1993-07-06) column 13, line 44-47; figure 10 column 21, line 21-43	1-4,8,9, 13-15, 23,27

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 September 2003	09/09/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Durville, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 03/02124

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3521109 A	18-12-1986	DE 3521109 A1	18-12-1986
US 4458153 A	03-07-1984	NONE	
US 5224604 A	06-07-1993	AU 7587791 A WO 9115302 A1	30-10-1991 17-10-1991